The Colusa Basin is a particularly important area for waterfowl and shorebirds and can provide a substantial amount of seasonally flooded wintering habitat.

LIST OF SPECIES TO BENEFIT FROM RESTORATION ACTIONS IN THE COLUSA BASIN ECOLOGICAL MANAGEMENT ZONE

- lamprey
- giant garter snake
- native anuran amphibians
- native resident fishes
- neotropical migratory birds
- waterfowl
- plants and plant communities.

DESCRIPTIONS OF ECOLOGICAL MANAGEMENT UNITS

STONY CREEK ECOLOGICAL MANAGEMENT UNIT

Stony Creek is a westside stream originating in the Coast Ranges and draining into the Sacramento River south of Hamilton City. Three storage reservoirs are located in the watershed. The primary focus area on Stony Creek is the stream reach below Black Butte Dam. This includes Stony Creek from Black Butte Dam to Interstate Highway 5 (I-5), I-5 to Highway 45, and Highway 45 to the confluence with the Sacramento River.

Stony Creek has a seasonal run off pattern of high winter and very low summer and fall flows, typical of western Sacramento Valley foothill streams. Unimpaired summer and early fall flows are 0 cubic feet per second (cfs) for 8-9 months, except in high rainfall years.

Summer and fall flows are higher than unimpaired flows as water is delivered below Black Butte Dam for agricultural use. These flows generally exceed 100 cfs in summer except in the driest years, when flows of only 10 to 30 cfs are released. Fall flows are generally less than 100 cfs except in the wettest years. Essentially no surface flows reach the Sacramento River during the summer and fall.

Water is diverted from several locations along the Stony Creek system below Black Butte Dam. About 150 cfs is diverted for irrigation from Black Butte Reservoir into the North Diversion Canal. Additional water is diverted at the South Diversion Canal, into the Tehama-Colusa Canal (TCC) east of Orland, and into the Glenn-Colusa Canal before the creek enters the Sacramento River.

Historically, riparian vegetation along Stony Creek below the site of Black Butte Dam was virtually non-existent.

A recent soil and mineral classification study by Glenn County indicates that Black Butte Reservoir has captured about 41 million cubic yards of sediment (Glenn County 1996).

ELDER CREEK ECOLOGICAL MANAGEMENT UNIT

Elder Creek is a westside tributary that enters the Sacramento River 12 miles south of Red Bluff. It flows into the Sacramento Valley from the west, draining a watershed of approximately 142 square miles. The watershed contains mostly shale, mudstone, and fine sedimentary deposits that produce minimal amounts of gravel, most of which is deposited where the stream enters the valley. No large gravel deposits are present in the lower stream reaches. An flood-control levee system in the lower section has directed and concentrated flows, increasing sediment transport and degradation throughout the reach.

Several small water diversions, but no large dams, have been constructed on Elder Creek. The flow is generally intermittent, with a widely fluctuating flow regime. Flow records indicate peak flows of more than 11,000 cfs, but the stream is normally dry from July to November.

Elder Creek has a natural flow pattern of moderate winter and spring flows and very low summer and fall flows, typical of streams in the western Sacramento Valley foothills. Summer and early fall flows are near 0 cfs, except in the highest rainfall years. In the wettest years, winter flows average 600 to 1,600 cfs. In the driest years, average monthly winter flows are only 5 to 20 cfs.

The stream reach from Rancho Tehama to the mouth is a low-gradient, braided channel. Approximately 20

miles upstream of the valley floor, the stream gradient increases rapidly in a rugged canyon area that supports resident fish, but probably has limited value for steelhead.

THOMES CREEK ECOLOGICAL MANAGEMENT UNIT

Thomes Creek is the largest gravel source in Tehama County. The stream has a watershed area of about 300 square miles. Thomes Creek enters the Sacramento River 4 miles north of Corning. No large dams have been constructed on the stream. The stream is usually dry or flowing intermittently below the U.S. Geological Survey (USGS) stream gage near Paskenta until the first heavy fall rains.

Thomes Creek has an unimpaired natural pattern of flashy winter and spring flows and very low summer and fall flows, typical of streams in the western Sacramento Valley foothills. The short-duration, high volume flows may impair riparian revegetation. Summer and early fall flows are near 0 cfs, except in the wettest years. Precipitation is seasonal, with more than 80 percent in December, January, and February. Precipitation in the drainage varies with elevation. The average annual rainfall is 15 to 45 inches

The lower reach of Thomes Creek has been significantly altered by the construction of flood-control levees and bank protection projects.

The lower Thomes Creek reaches contain large amounts of sediment and gravel. Thomes Creek has at least three year-round gravel mining operations and several seasonal ones. These gravel mining operations are conducted in compliance with the county gravel resource plan and permitted under terms of the Department of Fish and Game.

Thomes Creek is one of the most intact tributaries on the west side of the Sacramento Valley. Thomes Creek provides important spawning habitat for native Central Valley fish, such as Sacramento sucker, and Sacramento pikeminnow (squawfish). These native species may be a reason why the area is used by wintering bald eagles. Some experts believe that Thomes Creek ranks second in importance, behind Cottonwood Creek, in terms of conservation priorities on the west side of the valley. Thomes Creek is in remarkably good condition in the upper watershed and has a well-developed riparian forest along much of its upper reach.

COLUSA BASIN ECOLOGICAL MANAGEMENT UNIT

The Colusa Basin drainage area extends from the Coast Ranges on the west to the Sacramento River on the east. It received flow and sediment from small streams located between Stony Creek on the north and Cache Creek on the south. The drainage encompasses approximately 1,500 square miles in Glenn, Colusa, and Yolo counties; 570 square miles of this area consist of the respective watersheds of the westside tributaries, with the rest located in the relatively flat valley bottom. Numerous small streams, including forks and branches, constitute the watershed, about 11 of which flow directly into the Colusa Basin Drain. Access to the upper portions of most smaller westside tributary streams is blocked where the GCID canal intersects the streams.

The main conveyance system in the Colusa Basin is known as the Colusa Trough, the Reclamation District 2047 Drain, the Colusa Basin Drainage Canal, or, more commonly, the Colusa Basin Drain. Flows in the basin generally discharge into the Sacramento River heading southeast through various sloughs. Reclamation efforts that began in the 1850s have converted wetlands and sloughs into agricultural areas.

Agricultural drainwater from the basin also enters the Sacramento River near Knights Landing through the Knights Landing Ridge Cut. In past years, this return water contributed to elevated water temperatures in the lower Sacramento River below the town. Water temperatures during May and June often exceeded 70°F, which is detrimental to juvenile chinook salmon. Recent improvements in agricultural and water management practices, reduced flow volume and reduced temperature and chemical loading, have diminished the problems formerly related to drainwater.

The Colusa Basin Ecological Management Unit provides important seasonal and permanent habitats for many species of migratory waterfowl and shorebirds, and the federally listed giant garter snake.

VISION FOR THE ECOLOGICAL MANAGEMENT ZONE

The vision for the Colusa Basin Ecological Management Zone is to maintain or rehabilitate

important fishery, wildlife, and plant communities and ecological processes and functions that contribute to the health of the Delta. Attaining this vision will involve restoring or reactivating important ecological processes and functions that create and maintain habitats for fish, wildlife, and plant communities throughout the Ecological Management Zone and its component Ecological Management Units.

This vision focuses on restoring ecological processes and functions related to sediment transport and restoring seasonally flooded aquatic habitats that provide important wintering areas for waterfowl and shorebird guilds, and in providing wetland habitats that will contribute to the recovery of the giant garter snake. The vision also included a large cooperative program with landowners to improve the wildlife benefits related to agricultural practices in the area. In addition, it emphasizes maintenance or improvements to the ecological processes and improvements to fish habitats. Visions for these ecosystem elements follow.

Visions For Ecological Management Units

Stony Creek Ecological Management Unit

Many native fish species use the lowermost reach of Stony Creek, below Highway 45, at its confluence with the Sacramento River for rearing from fall through early summer when water is suitably cool. The vision is to maintain and improve valuable aquatic and terrestrial habitat types by restoring upstream areas to improve system integrity and increase habitat complexity at the confluence.

Elder Creek Ecological Management Unit

The vision for the Elder Creek Ecological Management Unit is to restore degraded habitat, the sediment balance (to reduce the quantity of fine sediments in the gravel substrate), and a more natural stream channel and riparian habitat in the lower section.

Because of levees and other structures, Elder Creek transports sediment through the lower sections instead of allowing deposition.

Elder Creek's lower reach and its confluence with the Sacramento River may occasionally provide an important seasonal, and sometimes extended, rearing habitat for juvenile anadromous and resident fish. Maintaining and improving the ecological processes related to streamflow; sediment supply; a and transport will also provide a clearly defined stream channel and riparian zone.

Thomes Creek Ecological Management Unit

The vision for the Thomes Creek Ecological Management Unit is establishing a clearly defined stream channel consistent with flood control needs, effectively enhancing sediment transport in the lower stream reach, and improving sediment delivery to the Sacramento River.

Colusa Basin Ecological Management Unit

The vision for the Colusa Basin Drain Ecological Management Unit is to remedy ecological problems related to the Colusa Basin Drain and the mainstem Sacramento River and to maintain and improve the area's value in providing seasonally flooded wetland habitat.

The Colusa Basin Drain is sometimes a significant source of warmwater inflow to the Sacramento River, but is probably not a significant problem during May and June. In general, rice floodup and maintenance precludes significant drainwater during this period. There may be thermal impacts resulting from rice field dewatering prior to harvest in late August and September. The drain may also draw chinook salmon from their natural migratory corridor, resulting in their loss to the spawning population.

Visions For Ecological Processes

Central Valley Streamflow: The vision is that streamflows would be maintained to support many ecological processes and functions essential to the health of individual streams in the Colusa Basin Ecological Management Zone and contribute to the health of the mainstem Sacramento River.

Coarse Sediment Supply: The vision for sediment supply in streams of the Colusa Basin Ecological Management Zone is that natural stream

sediments will contribute to stream channel formation and provide for native resident fish spawning and invertebrate production.

NATURAL FLOODPLAIN AND FLOOD PROCESSES: The Colusa Basin is one of the Sacramento Valley's natural overflow basins. The vision is to maintain the system's flood capacity, introduce nutrients to the system, and support natural regeneration and succession of riparian and riverine plant communities.

VISION FOR HABITATS

SEASONAL WETLAND HABITAT: The vision is that increased seasonal flooding of leveed lands, use of the Colusa Basin's natural flood detention capacity, protection and enhancement of existing wetlands, and development of cooperative programs with local landowners will contribute to increased habitats for waterfowl and other wetland dependent fish and wildlife resources such as shorebird, wading birds, and the giant garter snake.

RIPARIAN AND RIVERINE AQUATIC HABITAT: The vision is to maintain existing riparian and shaded riverine aquatic habitats and to restore these habitats where feasible that support terrestrial and aquatic species. Throughout much of this zone, riparian protection and restoration will be in conjunction with flood control and levee maintenance practices.

FRESH EMERGENT WETLAND HABITAT: The vision is to maintain and enhance existing permanent marshes in the Colusa Basin Ecological Management Zone.

FRESHWATER FISH HABITAT: Freshwater fish habitat is an important component needed to ensure the sustainability of resident native and anadromous fish species. The lower sections of these creeks are typical of fall chinook salmon spawning streams (Moyle and Ellison 1991). The quality of freshwater fish habitat in these creeks will be maintained through actions directed at streamflows, coarse sediment supply, stream meander, natural floodplain and flood processes, and maintaining and restoring riparian and riverine aquatic habitats.

ESSENTIAL FISH HABITAT: The streams in the Colusa Basin Ecological Management Zone have been tentatively identified as Essential Fish Habitat (EFH) based on the definition of waters currently or historically accessible to salmon (National Marine Fisheries Service 1998). Key features of EFH to maintain or restore in these creeks include substrate composition; water quality; water quantity, depth and velocity; channel gradient and stability; food; cover and habitat complexity; space; access and passage; and flood plain and habitat connectivity.

AGRICULTURAL LANDS: Improving habitats on and adjacent to agricultural lands in the Colusa Basin Ecological Management Zone will benefit native waterfowl and wildlife species. Emphasizing certain agricultural practices (e.g., winter flooding and harvesting methods that leave some grain in the fields) will also benefit many wildlife that seasonally use these important habitats.

VISIONS FOR REDUCING OR ELIMINATING STRESSORS

CONTAMINANTS: Pesticides and herbicides are applied extensively in this Ecological Management Zone and may adversely affect aquatic organisms. The vision is that contaminant input levels to the system will not impair restoration or maintenance of healthy fish, wildlife, and plant communities.

VISIONS FOR SPECIES

GIANT GARTER SNAKE: The vision for the giant garter snake is to contribute to the recovery of this State and federally listed threatened species in order to contribute to the overall species richness and diversity. Achieving this vision will reduce the conflict between protection for this species and other beneficial uses of land and water in the Bay-Delta. Protecting existing and restoring additional suitable wetland and upland habitats will be critical to achieving recovery of the giant garter snake. The proposed restoration of aquatic, wetland, riparian, and upland habitats in the Colusa Basin Ecological Management Zone will help in the recovery of these species by increasing habitat quality and area.

WATERFOWL: The vision for waterfowl is to maintain and restore healthy populations at levels that can support consumptive (e.g., hunting) and nonconsumptive (e.g., birdwatching) uses consistent with the goals and objectives of the Central Valley Habitat Joint Venture and North American Waterfowl Management Plan. Many species of

resident and migratory waterfowl will benefit from improved aquatic, wetland, riparian, and agricultural habitats. Increase use of the Colusa Basin Ecological Management Zone and possibly increases in some populations would be expected.

PLANT SPECIES AND COMMUNITIES: The vision for plan species and communities is to protect and restore these resources in conjunction with efforts to protect and restore wetland and riparian and riverine aquatic habitats.

Note on Chinook Salmon in the Colusa Basin Ecological Management Zone

Chinook salmon are not included in the vision for this Ecological Management Zone. Historically, Thomes, Elder, and Stony creeks sporadically supported spawning chinook salmon when rainfall and streamflow patterns allowed upstream migration. Under ideal flow conditions, these streams can still support fall-run chinook. These three creeks have been identified as "Essential Fish Habitat" by the National Marine Fisheries Service. In response to this, CALFED has reevaluated its approach and recommended actions and decided the proposed actions are appropriate for this Zone at this time.

The approach presented includes efforts to resolve uncertainties and problems arising from the ecological dysfunction of streamflow, coarse sediments, and floodplains. These processes need to be improved prior to developing or recommending actions to restore fall-run chinook salmon, which at this time is not warranted.

Future actions directed at fall-run chinook salmon, if appropriate, will depend on how well the system functions after issues related to streamflow and sediment transport and supply are reviewed and remedial projects are successfully implemented.

The role or value of fall-run chinook salmon in this Zone is uncertain at this time, and future recommendations will be based on credible science and projects implemented as adaptive interventions or experiments.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

The vision for the Colusa Basin Ecological Management Zone can be achieved by primarily relying on local resource conservation districts, landowner associations, watershed associations, watershed conservancies, water districts, and local landowners. In addition, the expertise of state, federal and local agencies can be used where appropriate to improve or assist in local planning efforts. Local groups presently include the Stony Creek Business and Landowners Coalition, the Thomes Creek Watershed Association, Tehama Colusa Canal Authority, and the Orland Unit Water Users Association. Key agencies in this effort are DFG, USFWS, the U.S. Natural Resources Conservation Service (NRCS), Reclamation, and local government agencies. The Colusa Basin Drainage District will play an important part in designing restoration efforts in the Colusa Basin Ecological Management Unit. The District recently completed major elements of a Basin Integrated Resource Management Plan and Watershed Priority Ranking Assessment Study. This planning process brought together representatives from agricultural, environmental, urban, and rural groups to identify, discuss, and resolve issues in a way that benefits all parties. In addition, local landowners, stakeholders, and private organizations will be important to restoration program success.

CENTRAL VALLEY HABITAT JOINT VENTURE

The Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan have developed objectives for wetlands in the Colusa Basin Ecological Management Zone. These objectives are consistent with the ERPP targets developed for this Ecological Management Zone.

CENTRAL VALLEY PROJECT IMPROVEMENT ACT

In addition to many provisions for the restoration of anadromous fish in the Central Valley, the Central Valley Project Improvement Act contains provisions related to "other" programs to protect, restore, and mitigate for past fish and wildlife impacts of the Central Valley Project including threatened and endangered plants and animals.

CALFED BAY-DELTA PROGRAM

CALFED has funded one ecosystem restoration projects in Colusa Basin. This project reduces sediment inflow to Sand and Salt creeks.

LINKAGE TO OTHER ECOLOGICAL MANAGEMENT ZONES

The Colusa Basin Ecological Management Zone is closely linked to the Sacramento River Ecological Management Zone and has a high degree of connectivity through the confluences of Stony, Elder, and Thomes Creeks. The Colusa Basin is directly linked to the Sacramento River through the Colusa Basin Drain. This Ecological Management Zone provides important habitats for a variety of migratory species including anadromous fish, waterfowl, and other species dependent on wetland and riparian habitats.

RESTORATION TARGETS AND PROGRAMMATIC ACTIONS

ECOLOGICAL PROCESSES

CENTRAL VALLEY STREAMFLOWS

TARGET 1: Maintain the existing seasonal runoff patterns that mobilize and transport sediments, allow upstream and downstream resident fish passage, and contribute to riparian vegetation succession. (◆).

PROGRAMMATIC ACTION 1A: Develop locally initiated programs to restore upper watershed health and functions.

PROGRAMMATIC ACTION 1B: Reduce excessive fire fuel loads in the upper watersheds.

PROGRAMMATIC ACTION 1C: Improve forestry management practices related to timber harvesting, road building and maintenance, and livestock grazing.

PROGRAMMATIC ACTION 1D: Develop a watershed management plan for Thomes Creek.

PROGRAMMATIC ACTION 1E: Develop a watershed management plan for Elder Creek.

PROGRAMMATIC ACTION 1F: Develop a watershed management plan for Stony Creek.

RATIONALE: *Colusa Basin Ecological Management Zone streams provide several features that are important within the Ecological Management Zone and for adjacent zones. Major ecological processes and functions that are driven by flow include gravel recruitment, transport, deposition, and cleansing. Stony, Thomes, and Elder creeks can provide sediment for transport to the Sacramento River and habitat in the Sacramento River for chinook salmon and other aquatic species. Maintaining and improving the ecological health of streams in the Colusa Basin Ecological Management Zone will require maintaining existing runoff patterns and eliminating other stressors such as invasive exotic plants (Arundo and tamarisk) that constrain ecological processes. In addition, improvements in watershed health will contribute to maintaining seasonal runoff patterns, water yield, and water quality and reduce sediment loading to downstream storage reservoirs.*

COARSE SEDIMENT SUPPLY

TARGET 1: Maintain the sediment available for transport during storms and seasonal flow events in Thomes Creek (◆◆).

PROGRAMMATIC ACTION 1A: Maintain sediment transport in Thomes Creek by continuing to monitor aggregate extraction activities to ensure sediment is available for delivery to the Sacramento River.

TARGET 2: Maintain the quantity of sediment transported from Elder Creek to the Sacramento River (◆◆).

PROGRAMMATIC ACTION 2A: Maintain sediment transport in Elder Creek by continuing to monitor aggregate extraction activities to ensure sediment is available for delivery to the Sacramento River

RATIONALE: *Sand and gravel extraction activities on the streams in the Colusa Basin Ecological Management Zone are conducted in compliance with local and state regulations. The tributaries are important sediment sources for the Sacramento River. Sediments contribute to several important ecological functions and are required for specific habitats, particularly chinook salmon and steelhead habitats. Black Butte Dam on Stony Creek has eliminated natural gravel recruitment to the lower stream reach. The feasibility of protecting Stony Creek, its stream*

and riparian corridor, and its contribution of sediment to the Sacramento River should be evaluated.

Natural Floodplain and Flood Processes

Target 1: Establish a desirable sediment deposition level in the Colusa Basin (◆).

Programmatic action 1a: Improve the Colusa Basin sediment deposition capacity by working with local landowners to develop an integrated plan consistent with flood-control requirements.

Rationale: *Floodplain processes include the natural floodwater and sediment detention and retention process whereby flows and sediment are retained within the floodplains. Retaining and detaining water and sediment in basin floodplains are controlled primarily by flow patterns and channel geomorphology, and secondarily by soils and plant communities.*

Habitats

Seasonal Wetlands

Target 1: Protect and manage 2,000 acres of existing seasonal wetland habitat consistent with the goals of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan (◆◆).

Programmatic Action 1a: Develop and implement a cooperative program to improve management of 2,000 acres of existing, degraded seasonal wetland habitat.

Target 2: Develop and implement a cooperative program to enhance 26,435 acres of existing public and private seasonal wetland habitat consistent with the goals of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan (◆◆).

Programmatic Action 2a: Restore and manage seasonal wetland habitat throughout the Ecological Management Zone.

Rationale: *Restoring seasonal wetland habitats along with aquatic, permanent wetland, and riparian habitats is an essential element of the restoration strategy for the Colusa Basin Ecological Management Zone. Restoring these habitats will also reduce the amount and concentrations of contaminants that could interfere with restoring the ecological health of the aquatic ecosystem. Seasonal wetlands support a high production rate of primary and secondary food species and large blooms (dense populations) of aquatic invertebrates.*

Wetlands that are dry in summer are also efficient sinks for the transformation of nutrients and the breakdown of pesticides and other contaminants. The roughness of seasonal wetland vegetation filters and traps sediment and organic particulates. Water flowing out from seasonal wetlands is typically high in foodweb prey species concentrations and fine particulate organic matter that feed many Delta aquatic and semiaquatic fish and wildlife. To capitalize on these functions, most of the seasonal wetlands of the Colusa Basin Ecological Management Zone should be subject to periodic flooding and overland flow from river floodplains.

Riparian and Shaded Riverine Aquatic Habitats

Target 1: Protect and maintain riparian vegetation along Stony Creek, Elder Creek, Thomes Creek, and the Colusa Basin Ecological Management Unit channels and sloughs where possible. This will provide cover and other essential habitat requirements for native resident fish species and wildlife (◆◆).

Programmatic action 1a: Develop a cooperative program to protect or rehabilitate riparian vegetation, where possible.

Rationale: *Healthy riparian corridors along creeks, sloughs, and channels, including those in the Colusa Basin Ecological Management Unit, provide essential cover, shade, and food for spawning, rearing, and migrating native resident fishes, and a wide variety of wildlife, neotropical birds, and other terrestrial species.*

Freshwater Fish Habitat and Essential Fish Habitat

Target 1: Maintain and improve existing freshwater fish habitat and essential fish habitat through the integration of actions described for ecological processes, habitats, and stressor reduction or elimination (◆◆).

PROGRAMMATIC ACTIONS: No additional programmatic actions are recommended.

RATIONALE: *Freshwater fish habitat and essential fish habitat are evaluated in terms of their quality and quantity. Actions described for ecological processes, stressor reduction, and riparian and riverine aquatic habitat should suffice to maintain and restore freshwater fish habitat and essential fish habitat. For example, maintaining freshwater and essential fish habitats is governed by actions to maintain streamflow, improve coarse sediment supplies, maintain stream meander, maintain or restore connectivity of Stony, Elder, and Thomes creeks and their floodplains, and in maintaining and restoring riparian and riverine aquatic habitats.*

AGRICULTURAL LANDS

TARGET 1: Cooperatively manage 111,285 acres of agricultural lands (◆◆).

PROGRAMMATIC ACTION 1A: Increase the area of rice fields and other crop lands flooded in winter and spring to provide high-quality foraging habitat for wintering and migrating waterfowl and shorebirds and associated wildlife.

PROGRAMMATIC ACTION 1B: Convert agricultural lands in the Colusa Basin Ecological Management Zone from crop types of low forage value for wintering waterfowl and other wildlife to crop types of greater forage value.

PROGRAMMATIC ACTION 1C: Defer fall tillage on rice fields in the Colusa Basin Ecological Management Zone to increase the forage for wintering waterfowl and associated wildlife.

RATIONALE: *Following the extensive loss of native wetland habitats in the Central Valley, some wetland wildlife species have adapted to the artificial wetlands of some agricultural practices and have become dependent on these wetlands to sustain their populations. Agriculturally created wetlands include rice lands; fields flooded for weed and pest control; stubble management; and tailwater circulation ponds.*

Managing agricultural lands to increase forage for waterfowl and other wildlife will increase the survival rates of overwintering wildlife and strengthen them for migration, thus improving breeding success (Madrone Associates 1980)

Creating small ponds on farms with nearby waterfowl nesting habitat but little brood habitat will increase production of resident waterfowl species when brood ponds are developed and managed properly. Researchers and wetland managers with the DFG, U.S. Fish and Wildlife Service and the California Waterfowl Association have found that well managed brood ponds produce the high levels of invertebrates needed to support brooding waterfowl. Other wildlife such as the giant garter snake will also benefit. Restoring suitable nesting habitat near brood ponds will increase the production of resident waterfowl species.

Restoring nesting habitat, especially when it is near brood ponds, will increase the production of resident waterfowl species. When the restored nesting habitat is properly managed, large, ground predators are less effective in preying on eggs and young of waterfowl and other ground nesting birds. Managing agricultural lands to increase forage for waterfowl and other wildlife will increase the overwinter survival rates of wildlife and strengthen them for migration, thus improving breeding success (Madrone and Assoc. 1980).

REDUCING OR ELIMINATING STRESSORS

CONTAMINANTS

TARGET 1: Reduce the adverse effects of herbicides, pesticides, fumigants, and other agents that are toxic to fish and wildlife in the Colusa Basin Ecological Management Zone (◆).

PROGRAMMATIC ACTION 1A: Work with local agricultural interests and water districts implement and evaluate a contaminant effects study.

RATIONALE: *Contaminants from point and nonpoint sources affect water quality and survival of fish, waterfowl, and the aquatic foodweb. Contaminants may cause severe toxicity and organism mortality or long-term, low-level toxicity that affects species' health and reproductive success.*

INVASIVE RIPARIAN AND MARSH PLANTS

TARGET 1: Eradicate Arundo and tamarisk in watersheds where they have only small population, then concentrate on eradicating satellite populations

extending beyond major infestations, and finally, reduce and eventually eliminate the most extensive populations (◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative pilot study to control Arundo (false bamboo) and tamarisk (salt cedar) in streams within the Colusa Basin Ecological Management Zone.

RATIONALE: *Invasive riparian and marsh plants have become sufficiently established in some locations to threaten the health of the Bay-Delta ecosystem. The riparian and salt marsh plants that pose the greatest threats to aquatic ecosystems are those that directly or indirectly affect rare native species, decrease foodweb productivity, and reduce populations of desired fish and wildlife species.*

Factors that relate to the degree of influence invasive riparian and salt marsh plants have on the Bay-Delta include additional introductions from gardens and other sources, and ground disturbances and hydrologic regimes that create favorable conditions for their establishment.

The effects of Arundo's ability to alter ecosystem processes may be profound. It is far more susceptible to fire than native riparian species. However, although it recovers from fires, most native vegetation does not, leading to increased postfire dominance by Arundo. By increasing sedimentation after establishing in stream channels, Arundo stabilizes islands, hinders braiding and shifting patterns in stream channel movement, and prevents native stream channel vegetation from establishing. An example of this can be seen at Stony Creek in northern California. Because Arundo has a vertical structure, it does not overhang water like native riparian vegetation. The result is less shade over water, providing less cover, increased water temperatures, and altered water chemistry, all conditions that can harm fish and other existing aquatic organisms and ultimately change the aquatic species composition.

Tamarisk is widespread in California rivers; however, an accurate assessment of the extent and rate of spread of the weed is unknown. Like Arundo, more survey mapping is needed to determine the extent of tamarisk, the levels of threat posed by the weed, the best time to control it safely, and a prioritized strategy for removing it.

REFERENCES

California Department of Fish and Game. 1993. Restoring Central Valley streams: a plan for action. November 1993.

California Department of Water Resources. 1994. Use of alternative gravel sources for fishery restoration and riparian habitat enhancement in Shasta and Tehama counties, California. Northern District. August 1994.

Madrone Associates. 1980. Sacramento-San Joaquin Delta wildlife habitat protection and restoration plan. Prepared for the California Department of Fish and Game and U.S. Fish and Wildlife Service.

Moyle, P.B., and J.P. Ellison. 1991. A conservation oriented classification system for the inland waters of California. California Fish and Game 77(4): 161-180.

National Marine Fisheries Service. 1998. Draft proposed recommendations for amendment 14 to the Pacific Coast salmon plan for essential fish habitat. March 26, 1998.

The Nature Conservancy. 1995. Sacramento Valley and foothill bioregional biological scoping project.

U.S. Fish and Wildlife Service. 1997. Revised draft restoration plan for the anadromous fish restoration program: a plan to increase the natural production of anadromous fish in the Central Valley of California. May 30, 1997.

◆ BUTTE BASIN ECOLOGICAL MANAGEMENT ZONE

INTRODUCTION

The ecological health of the Bay-Delta depends on ecological processes and functions, habitats, and fish and wildlife species present in Butte Basin Ecological Management Zone streams, wetlands, and floodplains. The status and abundance of spring-run chinook salmon and steelhead trout are important measures of the health, not only of the Sacramento-San Joaquin River Delta, but also of the Butte Basin. The Butte Basin Ecological Zone supports the Delta ecosystem through significant contributions of streamflow, sediments, and other attributes.

The Butte Basin Ecological Management Zone provides habitat for a wide variety of fish, wildlife, and plant communities and habitats. These include spring-run chinook salmon, steelhead trout, resident fish communities, waterfowl, riparian vegetation, and seasonally and permanently flooded wetlands. The Butte Sink contains important refuge areas including Gray Lodge Wildlife Area, Butte Basin Wildlife Area, Butte Sink National Wildlife Refuge, and the Butte Sink Wildlife Management Area.

Important ecological processes and functions in the Butte Basin Ecological Management Zone include the annual streamflow and storm runoff patterns, sediment supply and gravel recruitment, and stream meander in each stream's watershed. These important processes are in a reasonably healthy condition throughout the ecological management zone, but specific improvements are needed in certain watersheds. The greatest need is to maintain processes closely linked to the natural streamflow regime. Continued efforts toward improving low flows and reducing physical barriers to fish migration will improve the overall ecological health of the watersheds in the basin while contributing to species restoration.

Important fish and wildlife resources in the basin include spring-run chinook salmon, fall-run chinook salmon, steelhead trout, resident fish guilds, waterfowl guilds, shorebird and wading bird guilds, and riparian wildlife guilds. Generally, the wildlife populations are healthy. Spring-run chinook and steelhead, however, need to achieve higher sustainable annual population levels before they are considered healthy and no longer a problem in the Delta. Achieving healthy status for these fish populations is also dependent on implementing restoration actions downstream of this ecological management zone.

Photo © California Department of Water Resources

Important habitats in the Butte Basin Ecological Management Zone include anadromous fish migration, holding, spawning, and nursery habitats (freshwater and essential fish habitats), which are needed to maintain spring-run chinook and steelhead and other chinook populations. Seasonally flooded wetlands are prevalent through the lower portions of the basin and are extremely important habitat areas for waterfowl, shorebird, and wading bird guilds. Riparian and riverine aquatic habitat is important to aquatic and terrestrial species. Woody debris, such as tree branches and root wads, provide important cover for young fish. Healthy riparian vegetation provides a migration corridor that connects the mainstem Sacramento River with habitats in the upper watershed. This corridor is used by terrestrial species, such as birds and mammals.

Stressors to ecological processes, habitats, and species in the zone include diversion structures in the streams; unscreened diversions; insufficient flow in the lower portions of most of the streams, which may seasonally inhibit the upstream and downstream migration of anadromous fish; areas of inadequate riparian vegetation and woody debris; and the potential illegal harvest of spring-run chinook salmon